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Meteorological Data Bases Available for the United States Department of Energy Oak Ridge Reservation

Rodney H. Strand
Charles W. Miller

ENVIRONMENTAL SCIENCES DIVISION
Publication No. 1184

OAK RIDGE NATIONAL LABORATORY
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METEOROLOGICAL DATA BASES AVAILABLE FOR THE UNITED STATES
DEPARTMENT OF ENERGY OAK RIDGE RESERVATION

Rodney H. Strand and Charles W. Miller¹

ENVIRONMENTAL SCIENCES DIVISION
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¹Health and Safety Research Division.

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ABSTRACT

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Solar radiation, precipitation, wind, and temperature phenomena are being monitored at two sites on the Oak Ridge Reservation -- Oak Ridge and Walker Branch Watershed. For these two sites and two non active sites on the Reservation, height of the instruments, the available data for the parameters, and the temporal distribution of the data collected are described. Examples of data access and the contact for accessing the data through the Environmental Sciences Division Data Center, ORNL, are given.

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INTRODUCTION

Meteorological data are necessary for quantitatively studying the factors affecting the behavior of airborne contaminants, the growth of plants and animals, and possible driving forces behind air transport phenomena. These data are required for analyzing releases of airborne contaminants from proposed facilities and evaluating the potential impact of these contaminants on their surroundings. Atmospheric dispersion calculations from Gaussian plume models are derived using site-specific meteorology and the characteristics of stacks which emit airborne combustion wastes. The meteorological data described in this report are invaluable for characterizing the climatic regimes present in the natural surroundings of the Oak Ridge Reservation. As research continues on the Reservation under the Environmental Research Park (ERP), these data will provide the baseline information for noting climatic trends and for developing additional meteorological monitoring stations and instrumentation. Sources in the immediate vicinity of Oak Ridge National Laboratory (ORNL) within the Oak Ridge Reservation have meteorological data (Hilsmeier 1963, U.S. Atomic Energy Commission 1953) which may be used for assessments like those mentioned above. Also, two other monitoring sites, currently inactive, provide some extant data. However, not all of these data are automated and readily accessible. This report describes the meteorological data available for the Reservation and ORNL, and identifies the time span for each site. Computer access and the parameters measured at each of the data collection sites also are summarized. Summaries of complete data for

each site are presented on a monthly and annual scale, with daily summaries available from the authors.

OAK RIDGE TOWNSITE

Four sites for monitoring meteorological data are located in the immediate vicinity of Oak Ridge National Laboratory (Fig. 1). Two of these sites, Walker Branch Watershed on the Oak Ridge Reservation and Oak Ridge Townsite located in the city of Oak Ridge, are still active. The other two sites, one located at Oak Ridge National Laboratory and the other to the south at the Tower Shielding Research Facility, are located on the Oak Ridge Reservation. However, these two sites are not currently active, even though the meteorological towers and equipment have not been removed. The Townsite station (Fig. 1) is the oldest site and has more complete data for all meteorological parameters measured than the other three sites. This station, as well as the other stations, is maintained by the Atmospheric Turbulence and Diffusion Laboratory (ATDL) of the National Oceanic and Atmospheric Administration (NOAA) and currently provides the National Weather Service data for the city of Oak Ridge. Two of the parameters (wind and solar radiation) are measured hourly at Cheyenne Hall, Department of Energy (DOE) Townsite Headquarters (3.2 km NE of Post Office), while the other data are collected at the ATDL office (3.2 km to the south of the Post Office) (Table 1). The solar radiation data for this site require correction for instrument degradation (Culkowski 1977). Missing and other errant data have been noted in the files and are summarized in Table 2. The totals, calculated from the hourly values

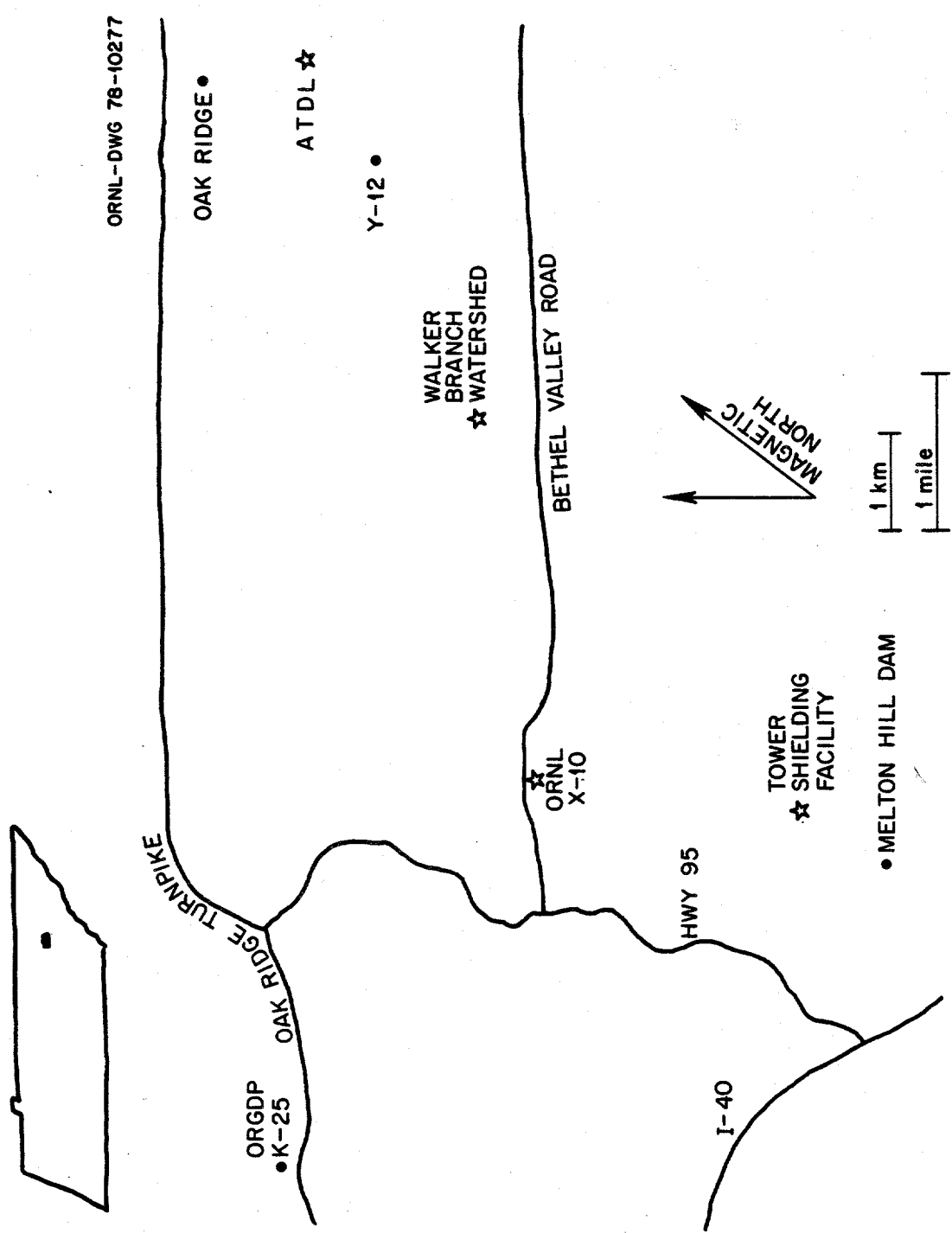


Fig. 1. Sites with available meteorological data for the DOE Oak Ridge Reservation.

Table 1. Meteorological data available at four sites in the ORNL vicinity. Available years for each site are presented in text. Elevation of monitoring instruments for each site are approximate height above ground level.

	Units	ATDL			X-10			TSF			WBW		
		1.2 m	15.2 m		1.2 m	42.7 m		1.2 m	95.7 m		29 m	44.5 m	
Air temperature	°F	x			x			x			x	x	
Precipitation	tenths of inches	x			x								
Solar radiation	langley		x								x	x	
Wind speed	mph		x		x	x			x		x	x	
Wind direction	16 pt compass		x		x	x			x		x	x	
Temperature gradient ^a	°F				x	x		x	x				
Temperature sign	t, o, -				x	x		x	x				
Dew point	°F	x											

^aTemperature gradient and temperature sign data are calculated from differences between two instruments at the levels indicated.

Table 2. Total number of hourly values for each parameter, month, and year of record at Townsite Meteorological station. Parameters include air temperature, precipitation, wind direction, wind speed, dew point, and temperature gradient.

Year	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
55	648	596	622	406	744	720	744	744	719	744	720	730
56	744	696	744	720	744	720	744	744	720	744	720	744
57	744	672	744	720	744	720	742	744	720	744	720	744
58	744	672	744	432	744	719	744	648	720	744	631	619
59	648	460	570	624	648	462	522	456	593	744	720	648
60	552	598	647	623	587	588	552	646	717	743	720	648
61	744	575	743	719	744	624	743	744	719	744	720	744
62	744	672	744	720	744	720	744	744	720	648	623	744
63	744	672	744	720	744	720	648	742	720	844	720	744
64	648	696	744	720	744	720	642	744	720	744	720	743
65	744	672	744	720	744	720	743	744	720	744	719	744
66	744	672	744	720	744	720	744	744	720	744	720	744
67	744	672	744	720	744	719	744	743	720	744	720	744
68	744	696	743	720	644	720	744	744	720	744	718	744
69	744	672	644	720	744	720	744	744	720	643	720	744
70	744	672	743	720	744	720	744	744	720	744	719	744
71	744	672	744	720	743	720	744	744	720	743	720	744
72	744	695	744	720	743	720	742	744	720	744	720	744
73	744	672	743	720	742	720	744	744	720	744	720	744
74*	744	672	744	720	744	720	743	744	720	744	719	744
75*	744	672	744	720	730	720	744	744	720	744	719	744
76*	744	693	743	718	744	719	743	744	719	744	720	743
77*	744	672	744	720	740	718	743	743	720	743	722	744

*Wind and temperature gradient information not recorded.

for each day multiplied by the number of days in the month, represent the number of nonmissing values for each parameter. Some errant data have been corrected as valid data have been made available. NOAA has daily data before 1955 (Environmental Research Laboratories 1972). However, hourly records for this site begin with January 1955 and extend through the present date.

ORNL (X-10) SITE

The X-10 meteorological tower is a 42.7-m structure located approximately 42.7 m east of building 2001 at ORNL (Fig. 1). This station collected hourly data (Table 1) from 1955 through 1972. However, only data for 1963-1969 are computerized in this data set. Some days are missing from these years. Table 3 shows the number of nonmissing values for each parameter monitored at the X-10 site. No coding errors were detected during processing. Thus, only missing hours or days will present a problem when using these data. No meteorological parameters are currently being monitored for the immediate ORNL site. Solar radiation data are not available. If a homogeneous data set, i.e., one with no missing data, is required for calculations, each parameter should be displayed and scanned for its appropriateness before use.

TOWER SHIELDING FACILITY (TSF)

The Tower Shielding Facility (TSF) is located near Melton Hill Dam which is approximately 3.2 km south of the X-10 tower site. This facility has a 95.7-m tower from which data were collected from 1956

Table 3. Total number of hourly values for each parameter, month, and year of record at Oak Ridge National Laboratory Meteorological Station. Parameters include air temperature, precipitation, wind direction, wind speed, dew point, and temperature gradient. Data for 1962 are not available.

Year	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
60	744	696	744	718	743	720	744	744	718	744	719	744
61	744	672	744	720	744	720	744	744	720	744	720	713
63	744	672	686	686	710	720	744	744	720	744	720	743
64	744	696	744	720	744	720	744	744	720	670	720	744
65	744	672	744	744	672	744	720	744	720	744	720	744
66	644	672	744	720	744	720	744	744	720	744	720	744
67	744	672	744	720	744	720	744	744	720	744	720	744
68	744	696	744	720	744	720	744	744	720	744	720	744
69	744	672	744	720	744	720	744	744	720	744	720	744

through 1972. Without all the original data available to us, data are currently available in this set only for years 1957-1959, 1961, and 1963-1967. Hourly values are present with missing data noted (Table 4). Parameters measured at this site include air temperature and temperature gradients, wind speed, and wind direction. However, the temperature gradient data, which are often used to specify atmospheric stability classifications, were discontinued and are not available after March 1965. Standard deviations of the wind direction are also used for such classifications, but these data were only monitored occasionally and cannot be used as a representative data set.

WALKER BRANCH WATERSHED

In October of 1977 the ATDL initiated an effort to characterize the incoming solar spectrum in the 0.285- and 50.0- wavebands at the Walker Branch Watershed (WBW). The spectrum is divided into five spectral bands for monitoring. Diffuse and direct solar radiation components can be determined from the measurements. Additional parameters monitored at 44.5- and 29-m heights include horizontal wind speed, wind direction, and air temperature. All instruments are scanned at 15-sec intervals with 1-min numerically averaged values recorded on magnetic tape. Backup hard copy strip charts also are used.

DATA ACCESS

The meteorological data described in this document are updated as additional data are made available. Each site has been established as a separate data set and the data have been formatted as 80-column card

Table 4. Total number of hourly values for each parameter, month, and year of record at Tower Shielding Facility Meteorological Station. Parameters include air temperature, wind direction, wind speed, and temperature gradient.

Year	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
57	743	672	744	695	744	720	744	744	720	744	720	744
58	744	672	744	720	744	720	744	744	720	744	720	517
59	0	0	0	0	0	373	744	744	720	742	720	744
61	744	672	744	720	744	690	696	702	720	744	720	744
63	744	672	663	627	652	712	735	744	718	744	720	741
64	743	696	744	720	744	685	715	728	702	739	720	744
65*	744	672	744	720	744	649	561	744	718	744	720	734
66*	740	642	744	720	738	687	744	744	718	744	720	743
67*	744	672	732	0	0	0	0	0	0	0	0	0

*Temperature gradient information not recorded.

images on disk or tape. Frequency of requests for access to the data do not warrant online (disk) archiving of each data set. Therefore, once the data for each site have been edited and corrected, they are archived on magnetic tape. The Statistical Analysis System (Barr et al. 1976) dictates the archival format for each data set, allowing rapid data handling, analysis, and display capabilities. The SAS format was chosen because of ease of use, flexibility, and efficiency in data input and editing routines for each data set. With simple program statements, data can be converted from English to units, e.g., of °F to °C. Some example data retrievals (Table 5) show the ease of use of the SAS format and how tables can be automatically generated. The use of these data in other programs can easily be accomplished by outputting the data to card, tape, or disk (Table 6). Since the computer code required to access each data set may change, specific requests for these data sets may be made to Julie Watts, Environmental Data Center, phone (615) 483-8611, ext. 3-0493.

CONCLUSIONS

These data should be carefully examined for completeness before use in any calculations because missing days and values for parameters have been noted. Consideration should be given to the location of the instruments at each of the sites, particularly for wind dispersion calculations. Wind and temperature gradients are not currently being monitored at the ORNL and TSF sites, and atmospheric dispersion calculations cannot be made for these sites. With a monitoring effort concentrated in these areas and directed towards the appropriate parameters and monitoring points, current release and dispersion problems could be appropriately addressed.

Table 5. Access of meteorological data in SAS format to generate total daily solar radiation

[Job control language for submitting computer job]

```
// EXEC SAS76
//SAS.MET DD DSN=ENVSCI.RAS14840.MET74,DISP=OLD
//SYSIN DD *
TITLE TOTAL DAILY SOLAR RADIATION FOR X10 BY MONTH WITHIN YEAR;
PROC MEANS SUM DATA=MET.X10;
BY YEAR MONTH;
VARIABLES SOLAR;
/*
//
```

Table 6. Retrieval of meteorological data as punched output
from SAS format

[Job control language for submitting a job]

```
// EXEC SAS76
//SAS.METEOR DD DSN=ENVSCI.RAS14840.MET,DISP=OLD
//SYSIN DD *
PROC MEANS SUM DATA=METEOR.MET; BY YEAR MONTH;
VARIABLES PRECIP;
OUTPUT OUT=TEMP PRECIP=PRECIP;
FILE PUNCH;
PUT @1 YEAR 2.0 @4 MONTH 2.0
@7 PRECIP 6.2;
/*
//
```

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